

Stomping Away at Growing Patterns – Applying Real-life Applications to Non-Numeric Growing Patterns

Brief Overview:

Students will explore patterns using their bodies, manipulatives, and real world applications. They will identify, extend, and verbalize pattern rules found in geometric designs, sound patterns, and pictures.

NCTM Content Standard/National Science Education Standard:

Algebra:

Understanding Patterns:

- Recognize, describe, and extend patterns, and translate from one representation to another.
- Analyze how repeating patterns are generated.
- Describe, extend, and make generalizations about patterns.
- Represent and analyze patterns using words.

Grade/Level:

Grades 2/3.

Duration/Length:

Three 60-minute lessons

Student Outcomes:

Students will:

- Identify, describe, and extend non-numeric growing patterns. *****
- Represent patterns in symbolic form and translate into real world applications.
- Create and verbalize a growing pattern using symbols, sounds, or manipulatives.

Materials and Resources:

Lesson 1

- http://pbskids.org/cyberchase/forreal/107_for_real.html - This video is 3:28 minutes long. It shows ways patterns are all around us and highlights the performing group Stomp.
- Access to the internet and viewing screen
- Chart paper one labeled “Real World Application” and “Pattern Observations”
- Pattern Blocks in bags for partners (10 blocks of each shape)

- Overhead pattern blocks
- Teacher resource 1
- Teacher resource 2
- Teacher resource 3
- Teacher resource 4
- Student resource – 1

Lesson 2

- Chart paper one labeled “Real World Application” and “Pattern Observations”
- Teacher Resource 5
- Teacher Resource 7
- Pattern Blocks in bags for partners (10 blocks of each shape)
- Grid paper
- 9” x 11” white paper
- Sentence strips
- Markers

Lesson3

- **Note* Lesson three may extend more than one day.**
- Teacher Resource 8
- Student Resource 5
- Teacher Resource 6
- Index cards
- Construction paper
- Games with pieces that can be used in patterns
- Pictures of patterns in murals, wrapping paper, or quilts generated by teacher
- Materials to create murals, wrapping paper, or illustrations of tiles.
- Chart paper from yesterday, labeled “Real World Application” and “Pattern Observations”

Preparation in Advance:

- Students need to be heterogeneous pairs.
- Pattern blocks need to be grouped for pairs of students.
- Students need to be able to identify hexagons, diamonds, triangles, and squares
- Teacher needs to cut out pictures or supply examples of murals, wrapping paper, or tiles. Students may also be asked to bring in these pictures prior to the lesson

Development/Procedures:

Lesson 1 –

Student Outcome –

Students will be able to identify, describe, and extend non-numeric growing patterns

Pre-Assessment (5 min)

- Create a growing pattern with overhead pattern blocks and ask students if they can predict the next level. See Teacher Resource 1 for examples.
- Have students think/pair/share to predict the next pattern level.
- Place the blocks in the next level of the pattern and instruct students to give a thumbs up if they agree.
- Repeat this with a different pattern. Ask students to share their predictions and explain how they came to a conclusion.
- Ask students if the sequence shows a pattern. Have students justify their answers by describing what makes a pattern. Call on several students to share their explanations of a growing pattern.

Launch (15 min)

- Ask students where we see patterns. Instructor will create a “Real World Application” chart of student responses.
- *Sample Responses – dance steps, music rhythms, clothing, architecture, wrapping paper.*
- Instructor will introduce a video clip by explaining that students are about to see some other ways we see patterns everyday. Show video or part of the video from: http://pbskids.org/cyberchase/forreal/107_for_real.html
- Ask students to describe patterns they saw in the video.
- Ask students how else stomp patterns can be represented. *Sample Response - the stomp patterns can be represented with pictures.*
- Place the clap, stomp, clap, stomp pattern on the overhead. Teacher resource 02 repeating stomp patterns.
- Ask students to stand up and follow the patterns.

Teacher Facilitation/Student Application (20 min)

- Ask students how they could change the repeating stomp pattern into a growing pattern. Invite students to rearrange the stomp/clap cards on the overhead. *Sample Response: clap stomp, clap, stomp, stomp, clap, stomp, stomp, stomp.*
- Have the class perform the stomp patterns and describe what is increasing and by how many. *The pattern increased by one stomp each time.*
- Use the patterns found on Teacher Resource 3 to show the second and third growing patterns. Emphasize to students that each step is called a “level” like a video game.
- Have students perform the patterned tasks.
- Questions to ask during and after performing patterns:
 - *What is happening to the pattern?*
 - *Why is the second step different than the first?*
 - *Describe what the next level would look like.*

- *Extend the pattern to the next level.*
- Prepare students to transition from doing stomp patterns to using pattern blocks by asking:
 - Do you see another pattern on the overhead? How are the shapes related to the activity? *Sample Response – The hexagon is always clapping. The triangle is always stomping.*
 - What is another way we can learn about patterns? *Sample Response – We can use shapes.*
- Distribute one set of pattern blocks to each pair of students and allow five minutes for students to explore and create an object or design.
- Instruct students to clear space on their desks by placing blocks in the top left corner.
- Model the first pattern on Teacher Resource 4.
- Ask students to recall what each step in the sequence was called. *Sample Response – a level like I completed in a video game, so I go to the next step.*
- Use the Think/Pair/Share strategy to make comparisons of level one and two with a partner.
- Ask pairs of students to copy the first two levels with their pattern blocks.
- Ask students to use the first two levels to predict the third level. Have students create this level using their pattern blocks.
- Have students check their neighbor's predictions and call one or two students to extend the pattern on the overhead.
- Have all students check their predictions by creating the next level.
- Call on two different students and ask if they agree or disagree with their classmates. Encourage students to justify their response.
- Ask students to predict the fourth level using pattern blocks. Discuss the prediction. Have a pair place the fourth level on the overhead.
- Ask students to generalize how the pattern is changing. *Sample Response – It is growing by 1 triangle each time.*
- Ask students to predict how much the next level will increase by and how they made their prediction. *It will grow by one more block because that is what it has been doing the whole time.*
- Explain to students that they have developed a rule that matches the pattern.
- Repeat the activity with the other patterns on Teacher Resource 4, which shows additional growing patterns to ensure understanding. Have students copy the levels, predict the next step, and check with blocks.
- Questions to ask during activity?
 - How do the levels change?
 - How many blocks will be in the next level?
 - How many blocks will be in all?
 - What do you think will be the next level?
- Once students are able to extend a growing pattern, again ask students to explain how their growing patterns were changing.

- Write down student observations on overhead or poster paper, “Pattern Observations”. Be sure to include how a rule can help you predict the number of elements in a pattern.

Embedded Assessment (15 min)

- Allow ten minutes for pairs to create a growing pattern using pattern blocks.
- Distribute 9’’ x 11’’ white paper and instruct students to draw their pattern and write a description of the pattern. This description should include a rule or statement describing how the pattern is changing. Allow students to use the phrases or words from the list that was created earlier. Allow students who have difficulty drawing shapes to use Student Resource 1 to cut and paste pictures or allow students to trace pattern blocks.
- Invite pairs to share the patterns and descriptions with the class.

Reteaching/Extension

- Give students who have difficulty transferring from stomp moves to pattern blocks pattern shapes found on Student Resource 1. These shapes can be cut and arranged into growing patterns.
- Use different colors in the charts created and be sure they are displayed in the classroom so that all students can easily see “Real World Applications” and “Pattern Observations.”
- For early finishers allow students to trade the patterns they created earlier in the lesson and extend each others’ patterns.
- Challenge students by asking: What do you think will be the tenth level?

Lesson 2

Student Outcome:

Students will be able to use a growing pattern to create a function table.

Pre-assessment (10 minutes)

- Distribute a set of pattern blocks to each pair of students.
- Students will work in pairs to create a growing pattern using pattern blocks.
- Ask students to explain to another pair of students how it is a growing pattern. Encourage students to refer to the “Pattern Observations” chart from Lesson 1.
- Instruct students to predict the next level in the other pair’s pattern. They must also explain why they chose those figures.
- Ask several students to explain to the class the pattern they either made or extended.
- Have students place pattern blocks in the top corner of the desk. Students may use manipulatives during the lesson as needed.

Launch (10 minutes)

- Ask students if they can brainstorm any places that were not mentioned the previous day where they can see patterns. *Sample Responses – dance steps, nature, music rhythms, raps, clothing, architecture, wrapping paper.*

- Have students independently draw a picture of a growing pattern using 9'' x 11'' paper. Have students use written words to describe the growing pattern. They need to include the rule, shapes, and pattern description in this explanation.

Teacher Facilitation/Student Application

- Instructor shows a vertical growing pattern on the overhead (Teacher Resource 5 and 6) and asks students to explain why this is a growing pattern. Ask students why it is different from patterns used on the previous day. *Sample Response – The patterns are growing up and down.*
- Ask students to predict the next figure and explain why they chose that figure.
- Instructor asks students to Think/Pair/Share the question: How is the pattern changing? And how can we record the information from the pattern?
- Instructor models the procedure for forming a table (Teacher Resource 5 and 6) by asking the following questions and using student responses to complete the table:
 - How many objects do you see in the first figure?
 - How many did we write in the first column?
 - How many objects do you see in the second pattern?
 - How did the first and second figure change?
 - What do you think the next figure will look like?
- Show a growing patterns using Student Resource 2 on an overhead (answer key on Teacher Resource 7). Distribute Student Resource 2.
- Ask the students how we can show patterns using a table *Sample response – create a function table like we just did.*
- Instructor and students will record the first column in the table together by asking the following questions:
 - How many objects do you see in the first figure?
 - How many should we write in the first column?
 - How many blocks do you see in the second pattern?
 - How did the first and second figure change?
 - What do you think the next figure will look like?
 - How is the pattern changing?
- Have students extend the pattern and complete the table with a partner.
- Have pairs continue extending a growing pattern and completing a table with the next level.
- If necessary assemble a small group to re-teach the process of extending patterns or completing tables. See differentiation for other ways to accommodate for all students.
- After working in pairs, ask students to share their results and show pictures of the extended pattern. Use an overhead transparency of Teacher Resource 7 with answers or record student answers so that they can grade their own work.

Embedded Assessment

Distribute Student Resource 3 and have students use the pattern to complete the table (Teacher Resource 7 a-b is the answer key).

Reteaching/Extension

- Use a small group setting for students having difficulties as you re-teach the process of extending patterns or completing function tables.
- Use Student Resource 4 to challenge students with various growing patterns. Allow students to use manipulatives or draw the patterns on grid paper. If appropriate have students think or record answers to any or some of the following questions:
 - How many objects do you see in the first level?
 - How many should we write in the first column?
 - How many blocks do you see in the second level?
 - How did the first and second level change?
 - What do you think the next level will look like?
 - How is the pattern changing?
- To challenge students limit the number of shapes they can use when they create a pattern.
- Designate “Pattern experts” or students who do understand the concept to assist another pair of students.

Lesson 3

Pre-assessment (5 minutes)

- Distribute index cards to students and ask students to write and illustrate a vocabulary word from the last two lessons or draw an example of a growing pattern. This will create a “Graffiti Wall”.
- Have students share index cards with a partner. When both partners agree that the index card accurately show growing patterns, ask them to put thumbs up.
- Call on a few students to share index cards with the class.

Launch (5 minutes)

- Allow students two minutes to review the “Real World Application” chart (from lesson 1), cover it up, and then ask pairs to create their own list. Encourage students to add to ideas that were not mentioned the first day.
Sample Response – poems, raps, step patterns, wrapping paper, quilt, clothing, architecture drawings, or ceiling/floor tiles.
- Ask students to share the real-life applications they brainstormed with the class.
- If students brainstormed ideas that are not already on the chart, have them add it to the “Real World Application” chart.
- When students are sharing ideas, ask them (if appropriate) to demonstrate the pattern.

- Show examples of real world patterns by showing a picture of a mural, wrapping paper, or quilt. Explain to students that today they will be able to create their own patterns as a final project.

Teacher Facilitation/Student Application (25 minutes)

- **Students** need to be heterogeneously grouped in fours.
- Allow students to choose an activity to show a growing pattern using the given list of activities. Before students choose the activity, describe each activity.
 - Mural – Create a growing pattern using shapes or pictures on a poster paper.
 - Step pattern – Create a growing pattern similar to the ones we created as a class or viewed in the video.
 - Wrapping paper – Create a growing pattern using shapes or pictures on construction paper. This can be used to wrap a gift.
 - Illustrating a tile pattern – Use grid paper or cut out sheets of construction paper to create a pattern similar to that of a ceiling or floor pattern.
- Distribute the project rubric (Student Resource 5) and discuss project expectations. Allow students to ask questions about the project. Answers may vary depending on classroom size and available materials.
- Once students are in groups of four, have students in each group count off by fours and assign jobs to each number.
 - 1 Liaison – The only person in the group who may ask questions.
 - 2 Mediator – Helps the group solve disagreements
 - 3 Recorder – Writes down pattern rule and description
 - 4 Time Keeper – Monitors time to ensure the group completes the activity
 - If there are 5 in a group this student can be a reporter and report to class the information written by the recorder.
- Display the “Job Requirements” (Teacher Resource 8) to help students remember their role in the group.
- Allow at least twenty minutes for students to work on their patterns before sharing with the class. *Note this activity may be extended longer than one day.

Embedded Assessment (10 minutes)

- Assess the group project as students are working by listening for students’ use of vocabulary and proficiency of extending their pattern.
- Projects will be assessed using the rubric (Student Resource 5).
- Assess students based on class discussion when asking: (Teacher Resource 9 can be made into an overhead).
 - What did you learn in your group?
 - What are some of the vocabulary words you talked about in your group?
 - What are some conclusions that can be drawn from this activity?
 - How did you feel about evaluating your partner’s work?
 - Why did you select your activity?
 - What did you notice about other groups’ projects?

- *Note if extending the project, ask students how they can prepare for tomorrow's extension and continuation of the activity?

Reteaching/Extension

- If students finish early, they can add an index card on the “graffiti wall” illustrating patterns that have a real-life application.
- Students can use games pieces to create growing patterns with a partner.

Summative Assessment: (15 minutes)

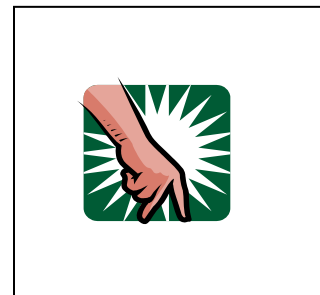
Distribute Student Resource 6. Attached is an extension activity for early finishers. See Teacher Resource 10 for an answer key.

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Student Resource 1
Sample Step Shapes to cut out



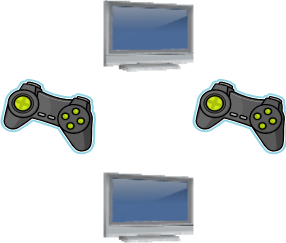
Student Name

Pattern 1

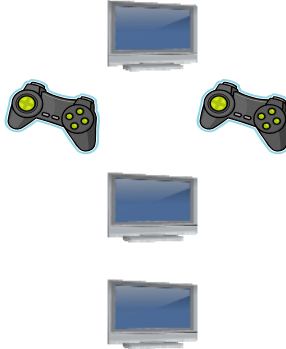
Student Resource 2 a



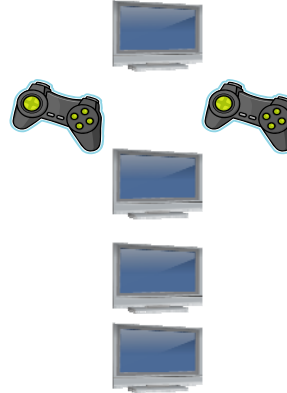
Level



Level 2







Level 3



Level 4

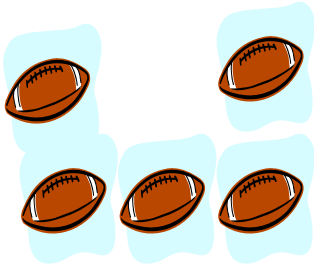
Level	1	2	3	4
number of TVs				
number of controllers				
total number of objects				

Pattern 3

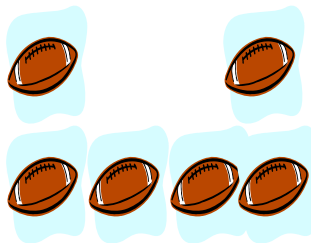
			
Level 1	Level 2	Level 3	Level 4

Level	1	2	3	4
Number of objects				

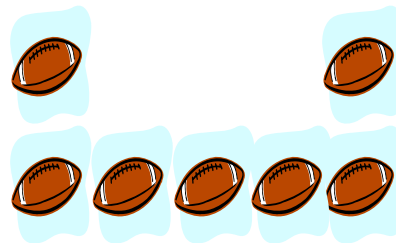
Find the Pattern with these Footballs Exit Ticket



Level 1



Level 2



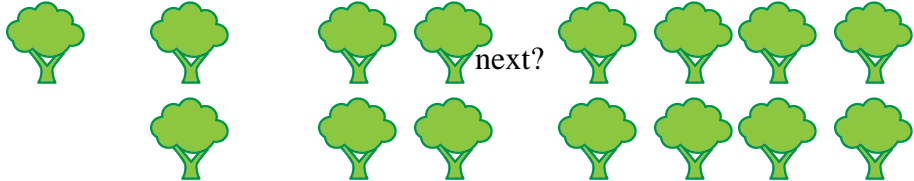

Level 3

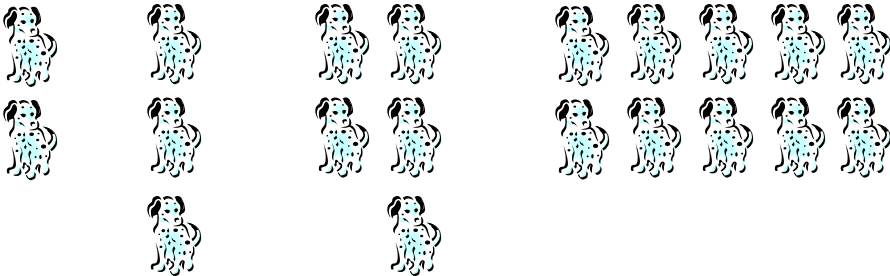
Level 4

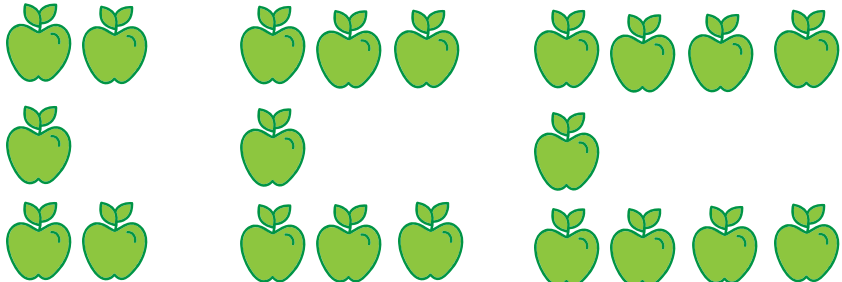
Draw the 4th level of the pattern. Complete the table.

Level	1	2	3	4
# of objects				

Growing Patterns

1.  How many  _____

2.  _____

3.  _____

Pattern Projects Rubric

Group Member Names

Due date for our project _____

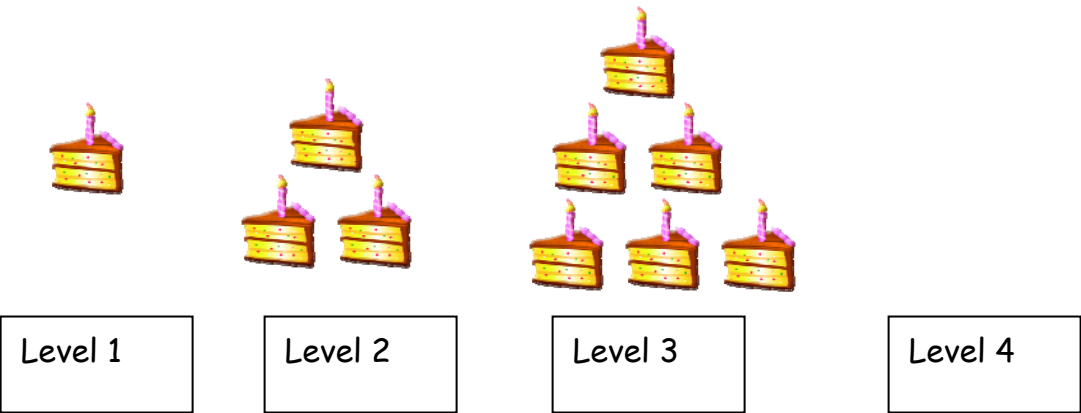
4 points	<p>The pattern includes the terms that repeat</p> <p>The pattern indicates growth (is a growing pattern)</p> <p>An explanation of the pattern is included</p>
3 points	<p>The pattern includes the terms that repeat.</p> <p>The pattern indicates growth (is a growing pattern)</p> <p>An explanation of the pattern is included</p>
2 points	<p>The pattern includes the terms that repeat</p> <p>The pattern indicates growth (is a growing pattern)</p>
1 point	<p>The pattern includes terms that repeat</p>
0 points	<p>No indication of the above</p>

Our Predicted Grade _____

Teacher Grade _____

Student Name _____

Written Response



1. Sketch what the pattern would look like in the 4th level. DO NOT WORRY ABOUT HOW GREAT YOUR BIRTHDAY CAKE LOOKS.
2. Use words and numbers to explain how the pattern grows.

3. Use the growing pattern to complete the table below.

Level	1	2	3	4
# of objects				

Written Response Extension

You are having a party. You want to invite lots of friends but your home only holds 50 people. You notice the following pattern as guests arrive at your door. Extend the pattern to complete the table until you discover when you need to stop admitting guests (letting people come inside). Describe the increase in the number of people and the total number. Explain the rule in the pattern. Use math words in your explanation.

Example of Table

Number of People at Door	Total (at party)
0	1
1	2
2	4
3	7

Sample Repeating Patterns



Level 1



Level 2



Level 3



Level 1



Level 2



Level 3



Level 1



Level 2



Level 3

Samples of non patterns



Level 1

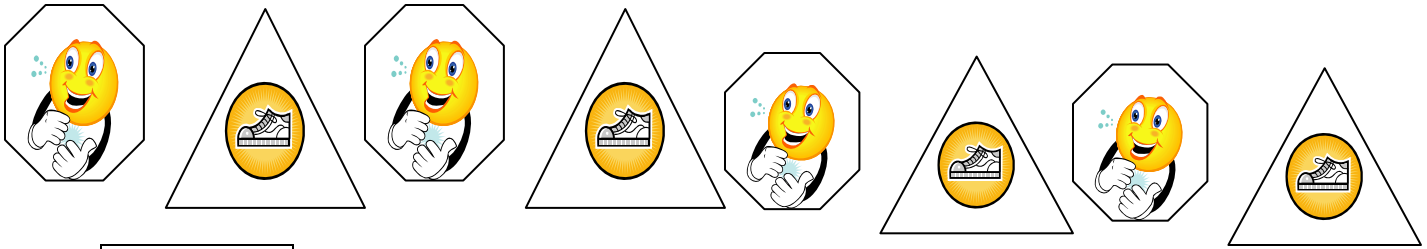


Level 2

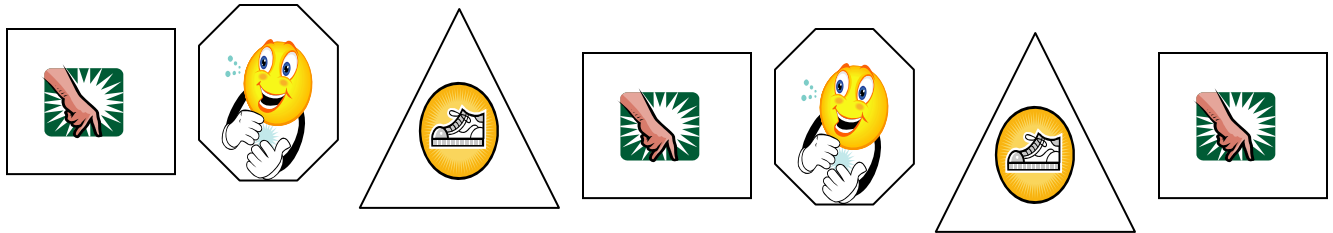


Level 3

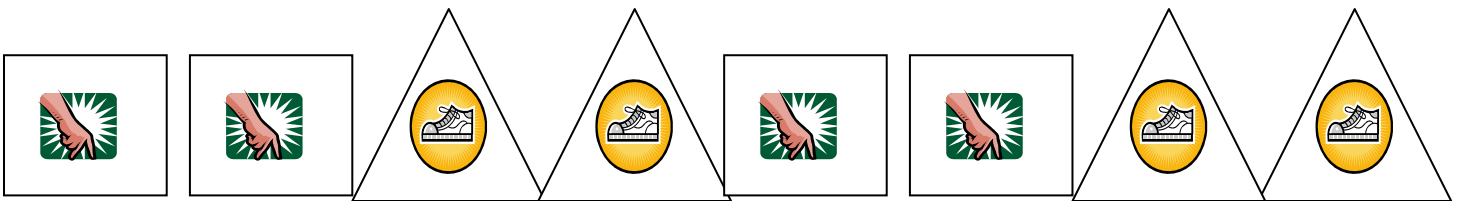
Teacher Resource 2
Stomp Repeating Patterns



Pattern 1



Pattern 2



Pattern 3

Teacher Resource 3 a
Stomp Growing Patterns

Level 1



Level 2



Level 3



Teacher Resource 3 b
Stomp Growing Patterns

Level 1

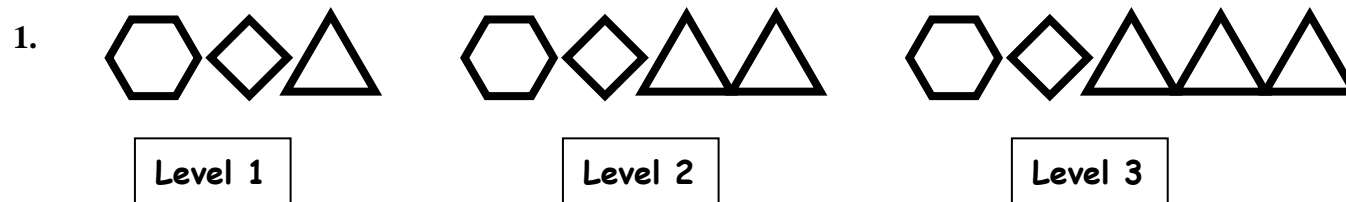


Level 2

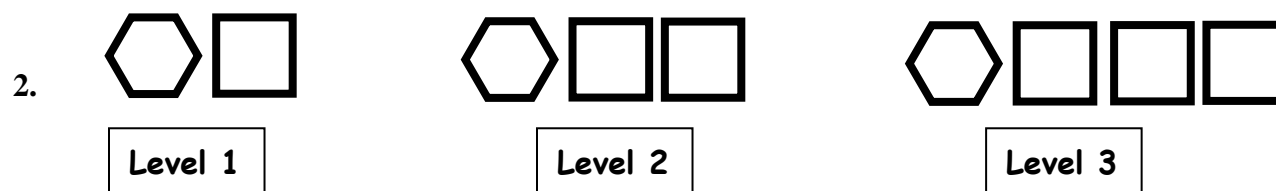


Level 3

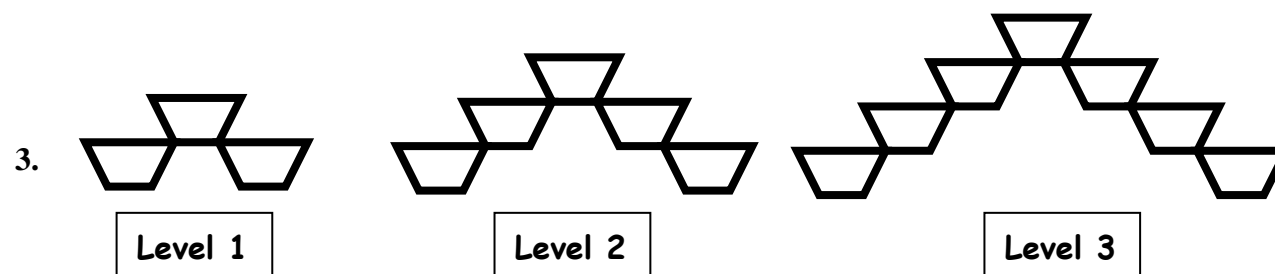




Level 4



Level 4



Level 4

Pattern 1



Level 1



Level 2



Level 3

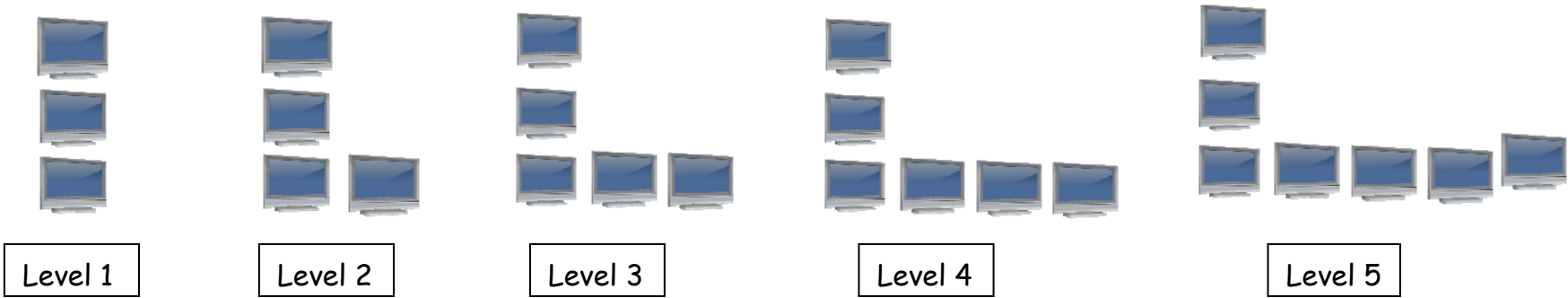


Level 4

Level 5

Core	1	2	3	4	5
# of TVs					

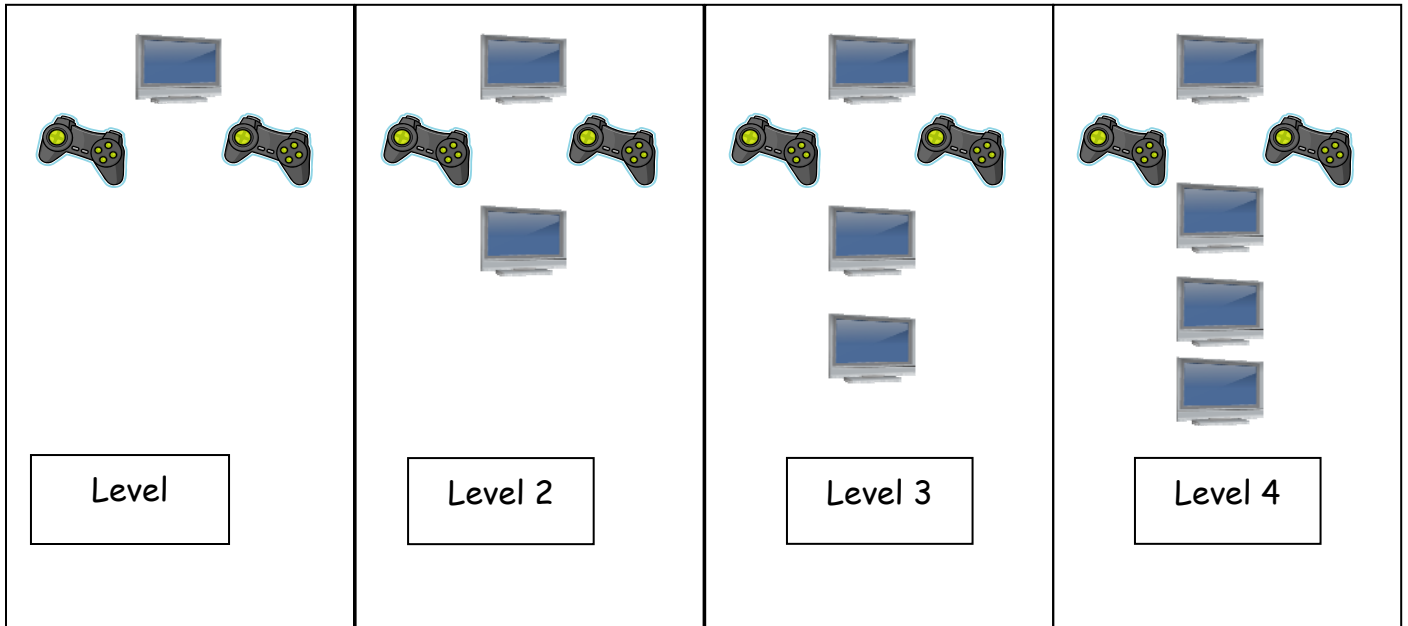
Pattern 1



Level	1	2	3	4	5
# of TVs	3	4	5	6	7

Pattern 1





Teacher Resource 7 a
Growing Patterns with tables Answers



Level	1	2	3	4
number of TVs	1	2	3	4
number of controllers	2	2	2	2
total number of objects	3	4	5	6

Pattern 3

Teacher Resource 7 b

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Level	1	2	3	4
Number of objects	4	8	12	16

Job Responsibilities

- 😊1 Liaison - The only person in the group who may ask questions to the teacher.
- 😊2 Mediator - Helps the group solve disagreements
- 😊3 Recorder - Writes down pattern rule and description
- 😊4 Time Keeper - Monitors time to ensure the group completes the activity
- 😊5 (if there are 5 in your group) Reporter - Share information with the class

Questions to Ask

What did you learn in your group?

What are some of the vocabulary words you talked about in your group?

What are some conclusions that can be drawn from this activity?

How did you feel about evaluating your partner's work?

Why did you select your activity?

What did you notice about other groups' projects?

Student Name _____

Written Response



1. Sketch what the pattern would look like in the 4th level. DO NOT WORRY ABOUT HOW GREAT YOUR BIRTHDAY CAKE LOOKS.
2. Use words and numbers to explain how the pattern grows.

Answer

The pattern changes because it adds a row of birthday cakes at the bottom. This row increases by one more than the previous row.

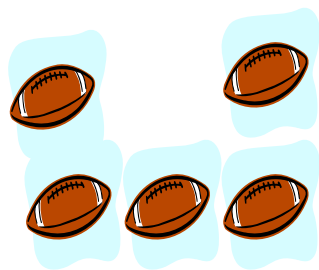
Written Response Extension

You are having a party. You want to invite lots of friends but your home only holds 50 people. You notice the following pattern as guests arrive at your door. Extend the pattern to complete the table until you discover when you need to stop admitting guests (letting people come inside). Describe the increase in the number of people and the total number. Explain the rule in the pattern. Use math words in your explanation.

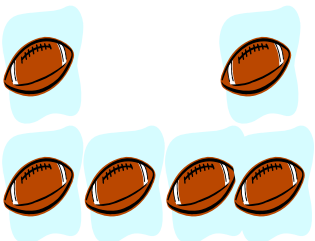
Example of Table

Number of People at Door	Total (at party)
0	1
1	2
2	4
3	7
4	11
5	16
6	22
7	29
8	37
9	46
10	56

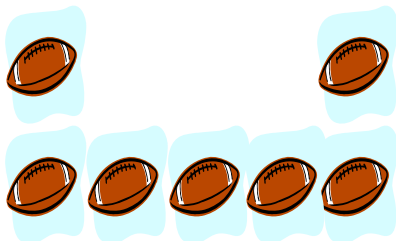
Find the Pattern with these Footballs
Exit Ticket



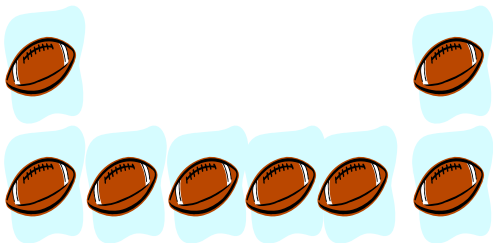
Level 1



Level 2



Level 3



Level 4

Draw the 4th level of the pattern. Complete the table.

Level	1	2	3	4
# of objects	5	6	7	8

